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03/30/2016

Subject: ClipperCreek comments addressing ENERGY STAR EVSE program Draft 3

Verena,

Thank you for this opportunity to work together and consider the E* proposed standard. These comments should be considered to be included with the comments previously submitted on 11/17/2015 which still contain relevant opinions on the lack of applicability of Energy Start ratings to EVSEs.

1. Energy Star staff has not collected enough consumption data and the use of the data for setting the proposed consumption threshold is directly unfair to ClipperCreek, Inc.

ClipperCreek was the ONLY Company to submit energy consumption details of our products. In order to provide useful information, we tested and provided information on a representative cross section of our product line. ClipperCreek is a company with a very wide product line, from low power cord sets that are delivered with the vehicles to high power wall stations that run at 3phases and 80Amps along with various other highly communicating stations.

In good faith, we provided a variety of EVSE power loss data to demonstrate to Energy Star staff how various applications can have varying base line power requirements in order to perform basic, critical functions.

It should be noted that ClipperCreek's products are very efficient with regards to energy losses, and as compared to the industry as a whole should be considered top tier across the board. This would only be evident if a cross section of data had been provided from many manufacturers for many EVSE types, but this is not the case.

Energy Star staff, essentially took ClipperCreek's range of data, from products that have different applications, chose the top 17% of this diverse group as meeting the criteria, and set the other 83% of our OWN PRODUCTS as inadequate!

This is totally unacceptable use of our information. Essentially taking just our own data set for our diverse products and choosing from that group to decide 83% unacceptable without a single other manufacture's certified input data as a comparison.

The rest of the information was NOT PROVIDED by MANUFACTURERS but rather by a 3rd party. The information may have been provided in good faith, but as it was not provided by the original equipment manufacturers, does not represent a truly diverse energy loss for products across the industry, does not have the equipment **manufacturer's endorsement** and should not have been considered. The additional data provided that did not come directly from manufacturers does not have the official endorsement or traceability and backing of the manufacturers of the equipment.

It is entirely inappropriate for Energy Star staff to collect information on power loss and accuracy from anyone but the manufacturers of EVSE equipment. Can ClipperCreek submit energy loss data on any stations we choose regardless of who manufactured them? Is Energy Star properly following their own procedures?

Here is the data ClipperCreek provided:

Figure 1 ClipperCreek data presented to Energy Star

	ClipperCreek, Inc.	12/14/2015	JmF	v11	1	2	3	4					
	Unit	Measured Line Voltage	Measured Line Current	Level	S2 Open, Circuit Card Only No Load Watts	S2 Closed, Relay Power Only No Load Watts	S2 Closed, Circuit Card & Relay IR Losses Watts	S2 Closed, EV Cable IR Losses Watts	Total Watts	EV Power Conductor Gauge AWG	EV Power Cord Length Feet	Power Input Conductor Gauge AWG	Power Input Conductor Length Inches
1	2016 Volt - cord set	120	0.02	1	2				2	16	25	14	12
	No Load	120	0.03	1	2	2			4				
	Intermediate current, 6A	118	5.70	1	2	2	1	7	12				
	Max Current, 12A	116	11.20	1	2	2	3	27	34				
2	PCS-120 - cord set	120	0.03	1	3				3	14	22	16	12
	No Load	120	0.06	1	3	4			7				
	Intermediate current, 10A	118	9.46	1	3	4	1	11	19				
	Max Current, 12A	117	11.31	1	3	4	2	16	25				
3	HCS-40 - Wall Mounted Basic	210	0.01	2	3				3	10	25	N/A	N/A
	No Load	207	0.03	2	3	4			7				
	Intermediate current, 16A	207	16.70	2	3	4	10	16	33				
	Max Current, 32A	206	29.80	2	3	4	19	52	78				
4	CS-40SG2 Smart Grid - Networked	206	0.07	2	15				15	10	25	N/A	N/A
	No Load	206	0.11	2	15	7			22				
	Intermediate current, 16A	207	16.70	2	15	7	4	16	42				
	Max Current, 32A	205	29.70	2	15	7	9	53	83				
5	HCS-60 - Wall Mounted Basic	209	0.01	2	3				3	8	25	N/A	N/A
	No Load	204	0.03	2	3	4			7				
	Intermediate current, 16A	208	16.80	2	3	4	4	10	21				
	Max Current, 48A	204	48.08	2	3	4	23	83	113				
6	CS-100 - Wall Mounted Basic	205	0.02	2	3				3	6	25	N/A	N/A
	No Load	205	0.14	2	3	26			29				
	Intermediate current, 32A	202	29.80	2	3	26	6	21	56				
	Max Current, 100A	205	83.10	2	3	26	25	163	217				

2. Energy Star staff manipulated ClipperCreek data with accuracies not represented by ClipperCreek and NOT supported by industry data

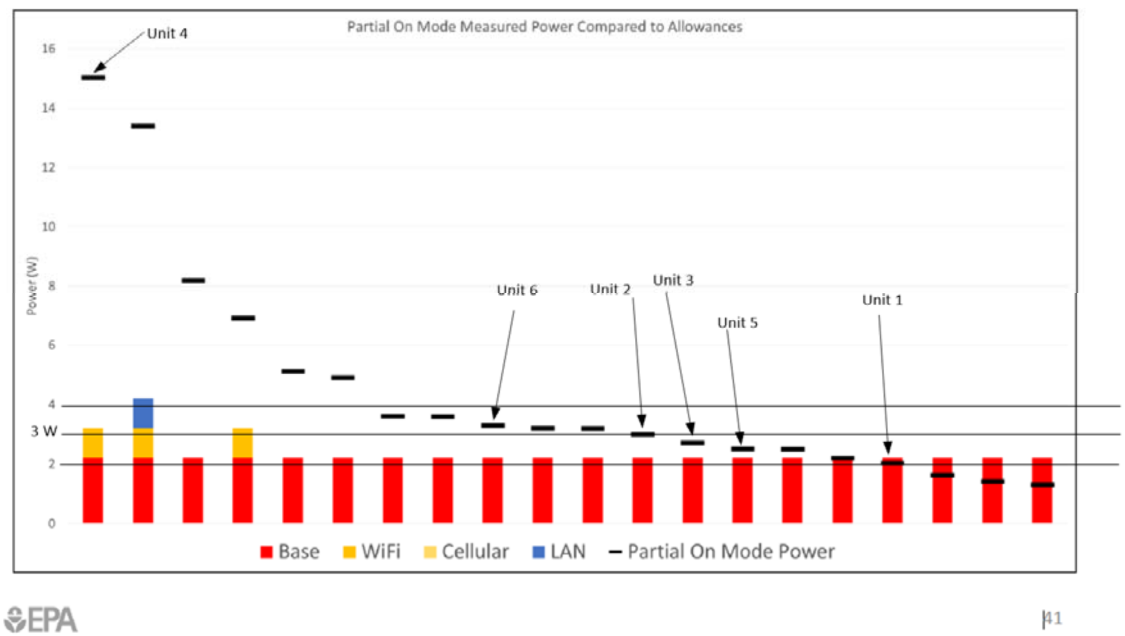
Reference table Figure 1, data presented with no digits to the right of the decimal point for accuracy as provided to Energy Star. This is because given the test procedure parameters and equipment, ClipperCreek was not able to represent any accuracy better than the nearest +/-1W. HOWEVER, as 6 out of 20 data points presented by Energy Star in **Figure 3** were ClipperCreek's products, with 5 out of the 6 presented as 3W or 2W, it is easy to see that the graphing of the data includes accuracies not proposed by ClipperCreek. Where are our products on this graph in the 2W or 3W positions? ClipperCreek presented 4 products that were represented as 3W, however only (1) 3W EVSE appears on the graph. Going back to our original spreadsheet, it could be seen that if an expansion of the data to the right of the decimal point is made, then there is a correlation to the graph is apparent, so apparently Energy Star staff restated the accuracy of our data.

Then a slice through 2.2W was presented as though it represented the industry as whole. Based entirely on incorrect and unsupported accuracy levels of ClipperCreek data in conjunction with the only other available data which did NOT COME from Manufacturers and did not have manufacture's endorsements or any traceability of accuracy as well. Not only is 2.2W way too low, the accuracy is NOT SUPPPORTED by INDUSTRY provided data. What is the accuracy of the data that was provided by the 3rd party and who has validated it if not the manufactures? Criteria of 2.2W is not supported by the basic accuracy of the data presented.

Figure 2 ClipperCreek NOT Correct Accuracy but Clearly Used

					EXPANDED and NOT REPRESENTED BY CLIPPERCREEK
	ClipperCreek, Inc.	12/14/2015	JmF	v11	1
	Unit	Measured Line Voltage	Measured Line Current	Level	S2 Open, Circuit Card Only No Load Watts
1	2016 Volt - cord set	120	0.02	1	2.0
	No Load	120	0.03	1	2.0
	Intermediate current, 6A	118	5.70	1	2.0
	Max Current, 12A	116	11.20	1	2.0
2	PCS-120 - cord set	120	0.03	1	3.0
	No Load	120	0.06	1	3.0
	Intermediate current, 10A	118	9.46	1	3.0
	Max Current, 12A	117	11.31	1	3.0
3	HCS-40 - Wall Mounted Basic	210	0.01	2	2.7
	No Load	207	0.03	2	2.7
	Intermediate current, 16A	207	16.70	2	2.7
	Max Current, 32A	206	29.80	2	2.7
4	CS-40SG2 Smart Grid - Networked	206	0.07	2	15.0
	No Load	206	0.11	2	15.0
	Intermediate current, 16A	207	16.70	2	15.0
	Max Current, 32A	205	29.70	2	15.0
5	HCS-60 - Wall Mounted Basic	209	0.01	2	2.5
	No Load	204	0.03	2	2.5
	Intermediate current, 16A	208	16.80	2	2.5
	Max Current, 48A	204	48.08	2	2.5
6	CS-100 - Wall Mounted Basic	205	0.02	2	3.3
	No Load	205	0.14	2	3.3
	Intermediate current, 32A	202	29.80	2	3.3
	Max Current, 100A	205	83.10	2	3.3

Figure 3 Energy Star Graph of Data used for determination of 2.2W Criteria



3. There was insufficient data presented for a determination of Idle Mode

Figure 4 Data Set EVSE Draft 1 Specification and Draft 3 Test Method Webinar

Data Analysis -Methodology

•20 models included in dataset

–All analyzed for Partial On Mode power consumption

–9 were analyzed for Idle Mode power consumption

Essentially, E* staff's asserts it is necessary to set a standard for Idle mode. Of the 9 products that were submitted with idle mode data, it should be noted that of the 6 sets of data came directly from ClipperCreek products, the rest were not supplied directly by EVSE manufactures and may be invalid. At a minimum the data set certainly does not represent a cross section of product types or manufacturers across the industry. What products has data been supplied for? Do they represent "real" NRTL listed products or unpopular and ineffective market outliers?

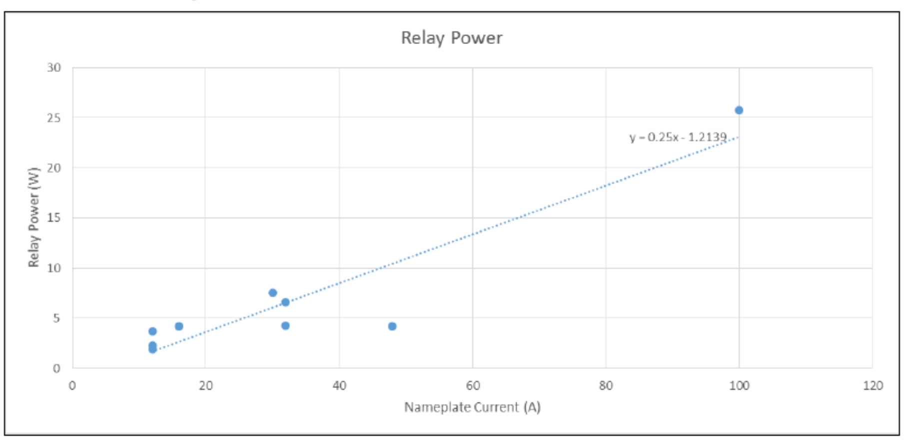
Essentially, with a 6 of the data points out of 9 coming from ClipperCreek's product line, the determination of the idle mode criteria does nothing more than slice ClipperCreek's own product line down an arbitrary demarcation point.

Since ClipperCreek EVSEs serve different purposes and therefore must have different idle mode energy loss levels, ClipperCreek was essentially punished for supplying data and having a variety of products.

Figure 5 Idle Mode from EVSE Draft 1 Specification and Draft 3 Test Method Webinar

Efficiency Criteria – Idle Mode

- 9 models in dataset analyzed for Idle Mode
- A new allowance term was introduced to the calculation for Idle State Power Requirement to reflect relay power, which increases with nameplate current
  - Seemingly the relay power varied with maximum nameplate current by a factor of 0.25 in a linear fashion



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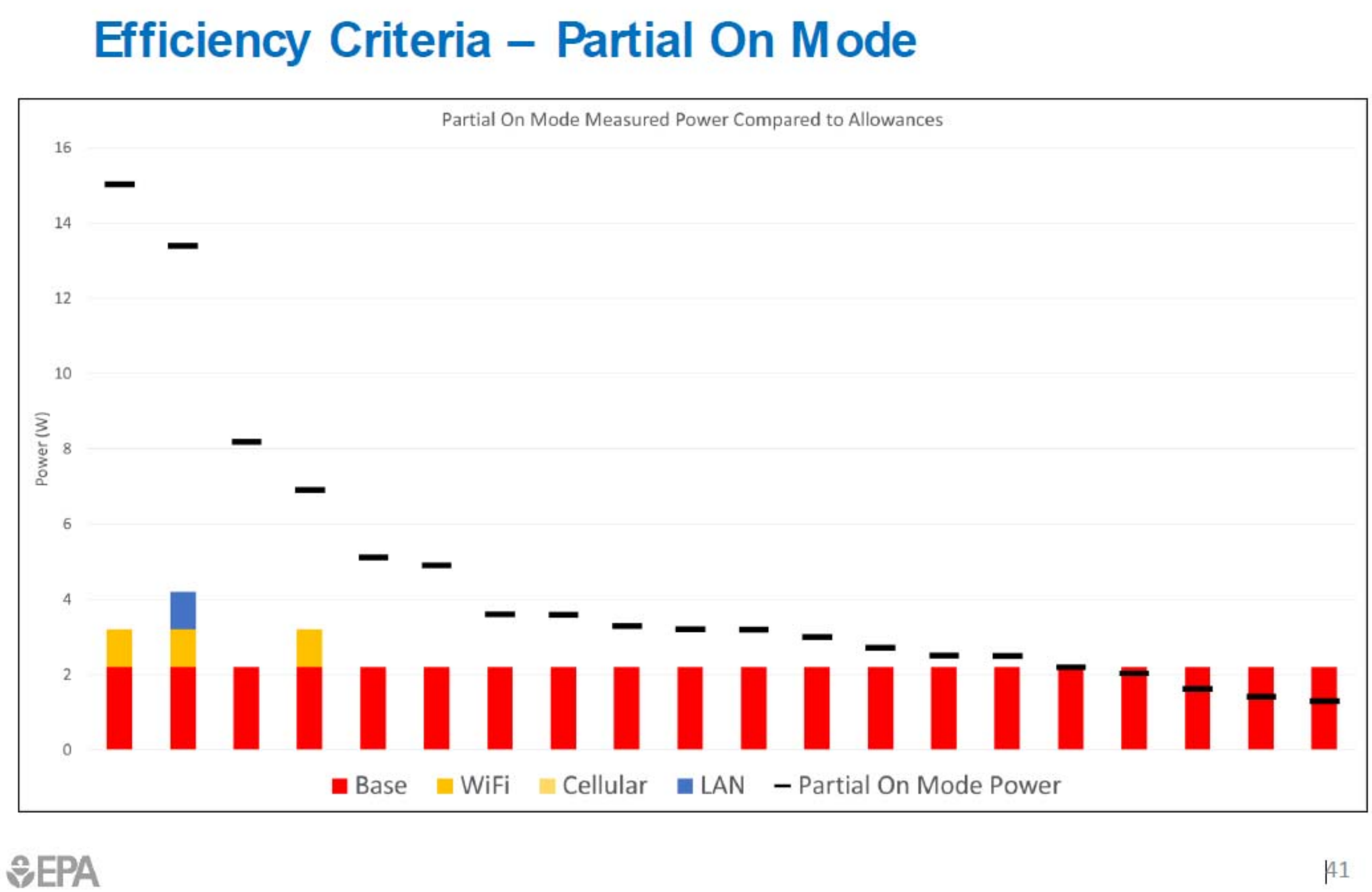
4. There was insufficient data presented for a determination of Partial On Mode

It is simply inappropriate to use information from an uncertified 3rd party for the determination of EVSE energy loss. There are more than 100 models of EVSEs on the market, data needs to be collected from more than one manufacturer.

What products has data been supplied for? Do they represent "real" NRTL listed products or unpopular and ineffective market outliers?

Figure 6 Idle Mode from EVSE Draft 1 Specification and Draft 3 Test Method Webinar



5. The EVSE is not a primary consumer of energy, but rather serves as an extension cord to connect an EV to the electrical service.

Energy Star is focused on the energy loss of the least relevant area in the EV charging system as a whole. The EVSE is not a significant consumer of energy in order to perform the primary function of EV charging.

Level 1 and 2 EVSEs are essentially extension cords. They are not consumers of relevant amounts of energy but rather simply serve the purpose of connecting the vehicle to the electrical service, like an extension cord that extends the power from a wall plug to an electrical appliance such as a refrigerator, which is the actual consumer of energy. For the EVSE to electric vehicle systems the consumer of electricity is the onboard battery charger and the electric vehicle sub-systems. The EVSE is merely an extension cord and safety device.

Consider this basic, generalized scenario for the entire charging system:

1. 10W 32A, L2 wall box, residential 240V: 5W consumed + 5W internal IR losses
2. 50W 25' of 32Amp cable, IR losses
3. 100W power loss in the premise wiring
3. 500W internal EV battery charger, assume approximately 94% efficiency overall

Consider a soon to be common place 200 mile BEV scenario. Over the course of an 8 hour charge, the 5W of losses in the EVSE are not relevant in the system as a whole. Certainly it leaves little energy reduction gains to be had, just 2.5W if cut in half at some high component cost to the EVSE manufacturers and consumers. Considering that during an 8 hour charge the CONSUMER of the electricity would use 61kW of energy, with inefficiencies on the order of 3kW. The 2.5W of standby power gains in the EVSE for the remaining 16 hours of the day would be insignificant. Energy Star should present justification for these gains with a consumer cost benefit model.

The efforts of the Energy Star team to develop, implement, validate, and market a new standard should be invested in an area that could have a significant effect, the EVSE is a poor choice.

Evidence needs to be presented that costs passed on to the consumer associated with implementation of power loss reduction for reducing EVSE Idle Mode or Partial Power Mode are sufficient to justify the power level target presented. An argument was presented for the IR energy loss in the cable but nothing was presented for the Base criteria of 2.2W.

6. Energy consumption data for communicating EVs is set way too low and not justified by industry data

Only a very moderate amount of industry data has been collected for communicating EVSEs. This data demonstrates that even the best communicating EVSEs need to have a higher base line in order to support various utility and cloud communication services. However, Energy Star has not applied their own standard practice to determine an acceptable criteria. It certainly could not be based on the 3 data points presented by a 3rd party with no information provided by manufactures as per page 44 of the presentation, <u>Efficiency Criteria – Idle Mode</u>.

Instead, arbitrary numbers of just 1W have been selected for all communication protocols. What is the justification for this selection?

The EVSE industry is very different from other residential communication devices such as a home WiFi router. The communications must have a high on time, they must interoperate with utility devices that are built to specialized protocols, and they must operate over a wider temperature range. The 1W suggestion is much too low and does not have sufficient justification.

7. The EVSE is a slave to the EV when connected therefore Idle Mode is not feasible

When the EVSE is plugged into the vehicle, it is a slave to the vehicle. It is required to turn on the contactor and connect the vehicle to the service mains whenever the vehicle asks. Therefore, it is not possible for the EVSE to power down once charging is complete. In fact, the EVSE has no knowledge of the EV's charging state. The EVSE cannot tell what the EV is doing, the state of charge, or even if the EV is using full power or no power.

The EVSE's purpose is to monitor for safety conditions such as service ground and CCID (GFCI) faults and to turn on the contactor upon EV requests.

EVs will turn the EVSE's contactors on and off at will, and often many times for each connection cycle. This is a basic function of the SAE-J1772 standard and cannot be deviated from or the EVSE will no longer function properly.

8. Do not dictate Contactor Energy Loss

There was much discussion about the energy consumption of the main contactor in the EVSE during the last Webinar.

The quality and properties of the contactor is dictated by electrical safety standards from Underwriters Laboratory and the NEC. Contactors and relays must be utilized in the main control path to the EV, electrical safety standards dictate this.

Energy Star should not set a minimum standard energy consumption for these switching devices. They are sourced from off the shelf UL listed components that are built for durability under short circuit conditions, reliability with regards to the lifetime on/off cycles of the product, and speed of disconnect in order to meet Safety requirements.

Setting a low threshold of energy loss for the contactor would only force EVSE manufacturers to undersize one of the critical functional safety components of the system. Lower power contactors are lower quality and lessor capable contactors. It would be undesirable for industry to be required to reduce safety and durability in order to obtain an Energy Star rating.

9. Require any EVSE to be NRTL certified as a criteria for Energy Star Rating

ClipperCreek recommends requiring NRTL certification of any equipment before it can receive an Energy Star rating. The basic function of the device is to safely extend wall power to the EVSE. The construction and operation of the EVSE is highly dictated by the NEC section 625 and UL safety standards. It would be possible for a manufacturer to build a substandard product that has not been 3rd party safety certified but still meet Energy Star requirements. It would be our opinion that meeting Energy Star requirements would be easier if the product did not have to meet the regulatory safety requirements, since no 3rd party NRTL would have certified the presence and effectiveness of various sensors and components, thereby reducing power loss. It would be undesirable for the Energy Star mark to be associated with such equipment. Customers could be confused because the perceived quality of a non-safety certified product could be elevated by the Energy Star mark appearing on a product that otherwise does not meet established safety requirements.

10. EVSEs have a variety of base line power losses as a result of product power and category

Higher power EVSEs need larger contactors. Larger contactors require greater power supply capabilities. As a matter of base line energy loss even during Partial On mode, it would be necessary to allow for higher power units to have higher energy loss base criteria.

This same principle applies to various types of communicating EVSEs. There should be multiple categories of stations such that the basic power supply allowance is sufficient to operate safety systems continuously, react to EV connections, adequately control contactors as commanded by the EV, and communicate with both the cloud and utility systems.

Utility centric communications is a specialty area that has not been vetted by the industry. There are many diverse variants and trial programs underway now or in the near future. It is too early to even collect industry data on these communicating devices and they are still evolving. Energy Star staff should consider a cutout for the communication portion of the energy consumption of utility communication systems until there is sufficient vetting and industry data available sometime in the next decade.

11. Basic EVSEs such as L1 cord sets and non-communicating L2 are Functional Safety Devices like a GFCI

EVSE may appear to be “consumers of power” for the purposes of “charging” electric vehicles, however that is simply not the case. The primary function of the EVSE is to provide a safe extension of the electrical service from the wall to the vehicle.

Common place examples of other products in the market that serve the same function as an EVSE are shown below in

Figure 7 and **Figure 8**. Perhaps these product do not look like EVSEs, but they are governed by standards from which EVSE standards are derived and perform nearly identical functions. Energy Star should not set standards for products that are basic safety devices that are in line with power transport conductors.

With regards to the energy consumption of the EVSE when in or out of the charging mode, functionality is all about addressing safety risks, as it would be with the GFCI cord set shown in

Figure 7. There are several basic safety functions that must be continuously operational in order to meet UL standards and the NEC. It would not be a good practice to attempt to turn off these functions even when the cord set is not actively charging, and is not allowed by the UL safety standards. It would clearly be a reduction of safety for the end user. Energy Star certification should not require the reduction of safety in order to meet the energy loss requirements.

For example, two of the critical functions that cannot be turned off are the continuous assurance that the cord set is de-energized, and verification of the bonded grounding path. There are also various self-test functions that the cord set may have to perform regularly.

Most of the energy consumption data presented in **Figure 1** are for basic units as described. Generally, they are already optimized for low energy loss in non-charging modes. Only unit 4 is a non-basic unit. Setting the energy level as low as 2.2W may well serve to do nothing more than penalize manufactures with product equipment types the industry needs, such as basic 32Amp charging stations and encourage manufacturers to reduce safety critical monitoring. This would only serve to make the products less safe. Safety is the primary function.

Figure 7 GFCI Safety Device Inline

Figure 8 Ground Faulting and Power Control for SPA

Summary

The EVSE market is in its infancy. Before energy loss criteria and test procedures can be finalized, data must be collected from an adequate number of manufacturers with their endorsement.

Generic, one size fits all approach will simply not work for setting the energy consumption level, but will result in some simple cord sets meeting the criteria and nothing else. This will also lead to low industry participation in the program.

ClipperCreek would encourage Energy Star staff to continue dialog with the industry and break the standards into more power levels with consideration for specific applications along with a temporary carve out for basic Level 1, basic Level 2, and utility centric communication systems.

ClipperCreek asks that accuracy of the data sets collected be presented for industry review. It appears that the 2.2W was established based on incorrect accuracy assumptions. ClipperCreek's data was presented with an accuracy of +/- 1W to Energy Star but was evaluated to a 10^{th} of a Watt or even more precise.

What products has data been supplied for? Do they represent "real" NRTL listed products or unpopular and ineffective market outliers?

Cost justifications for base Idle State and Partial On Mode needs to be presented to justify the impact to the consumer.

A justification for the energy consumption of communications devices should be based on industry data and not from other unrelated industries which do not have to meet the same safety criteria or operate under the same environmental conditions.

Thank you for the opportunity to comment.

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